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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

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FOR RELEASE: FRIDAY P.M.
July 18, 1969

RELEASE NO: 69-26A

PROJECT: MARINER MARS '69

(Approach and Near Encounter
Sequence of Events)

contents

NOTE TO EDITORS.	A-A1
GENERAL RELEASE.	1-7
MARINER 6, MARINER 7 MARS ENCOUNTER LOG.	8-11
MARS AS VIEWED BY MARINER CAMERAS IN FAR ENCOUNTER SEQUENCES.	12-13

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NEWS



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (202) 962-4155
WASHINGTON, D.C. 20546 TELS: (202) 963-6925

FOR RELEASE: FRIDAY P.M.
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NOTE TO EDITORS:

The Mariner 6 and Mariner 7 spacecraft will complete their multi-million-mile flights to Mars on the nights of July 30 and August 4, respectively.

A press room will open in the von Karman Auditorium at the Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, at 8:00 a.m. PDT*, Monday July 28, and will remain open on a 24-hour basis through Wednesday, August 6.

The attached pages include a summary of anticipated Mars encounter events, a day-by-day log and a computer rendering of the expected changing appearance of Mars as the Mariners photograph the planet during their approach.

A press conference outlining the expected encounter events will be held at 10 a.m. PDT Tuesday, July 29, in the JPL press room.

Please contact the JPL Public Information Office for further details if you plan to cover the Mariner encounter. Phone: Area Code 213 354-5011.

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* Because the Space Flight Operations Facility at JPL will be the command and data center for the Mariner activities and the von Karman Auditorium at JPL will be the information center, all times in this press kit supplement will be stated in PDT, California time.

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NEWS



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MARINER 6/MARINER 7 NEARING MARS

The Mariner 6 and Mariner 7 spacecraft will fly past Mars on the nights of July 30 and August 4, 1969, respectively. Time of closest approach is now estimated at 10:18 p.m. PDT, July 30, for Mariner 6 and 10:00 p.m. PDT, August 4, for Mariner 7. Altitude at encounter will be about 2000 miles for each spacecraft.

Mariner 6, launched from Cape Kennedy on February 24, will fly a total of 241 million miles in 156 days. Communications distance from Mars at encounter will be 59.5 million miles (about 5½ light minutes).

Total Earth-to-Mars distance to be travelled by Mariner 7, launched March 27, is 197 million miles in 130 days. Communications distance at encounter will be 61.8 million miles. Both spacecraft were boosted into space by Atlas-Centaur launch vehicles.

The Mariners were developed and their missions are conducted for the National Aeronautics and Space Administration by the Jet Propulsion Laboratory in Pasadena, California.

Mariner 6 will examine the equatorial regions of Mars. Mariner 7 will cover some of the same area, but will concentrate on the southern hemisphere and a portion of the south polar cap. Together, they are expected to furnish data as different as possible from the standpoint of geography and climate.

The mission follows the 1964-65 flight to Mars by Mariner 4 and is a precursor to the 1971 and 1973 Mars missions. Mariner 4 was the only other spacecraft to have photographed another planet.

In 1971 two Mariner-class vehicles will orbit Mars for three months, and in the 1973 mission, Project Viking, two spacecraft will orbit Mars and detach landing craft to descend to and operate on the surface.

Mariner 1969 mission objectives are to study the surface and atmosphere of Mars to establish the basis for future experiments in the search for extra-terrestrial life and to develop technology for future Mars missions.

The 1969 flights will not determine the presence of life on Mars but will help establish whether or not the Martian environment is suitable for life.

Television cameras aboard each spacecraft will photograph the full disc of Mars during the approach to the planet and selected surface areas at high resolution during the close Mars passage.

Thermal mapping of the areas photographed will be provided by an infrared radiometer (IRK) to correlate temperatures with surface visual appearance. A principal goal of the experiment is to determine whether the Martian polar caps are frozen carbon dioxide or frozen water.

The chemical constituents of Mars' upper atmosphere will be measured by an ultraviolet spectrometer (UVS). The experiment will identify and measure the distribution of a number of gases in the atmosphere -- principally oxygen, nitrogen and perhaps hydrogen.

Composition of the lower atmosphere and possibly the surface of Mars will be determined from measurements by an infrared spectrometer (IRS). The instrument may be able to detect the presence of some organic molecules in atmospheric concentrations as small as two parts in one-million.

An occultation experiment, in which the Mariners disappear from Earth behind Mars and their radio signals pass through the Martian atmosphere, will yield information on atmospheric pressures and densities.

Radio tracking data during encounter, as well as throughout the entire flight, contributes to still another experiment--celestial mechanics--which will provide information to refine astronomical data.

The Mariner encounter can be divided into three phases--far encounter or approach to Mars; near encounter or close passage by Mars; and playback of recorded near encounter science data after the fly by.

FAR ENCOUNTER (TV LIVE-FROM-MARS)

As the two Mariners approach Mars, they will take a series of TV pictures while the planet revolves through several Martian days (a Martian day is 24 hours, 37 minutes). The pictures will reveal general surface features not visible from Earth and the planet will be photographed at all longitudes. Only the north pole area will not be covered in the pictures. Some information may be obtained on the formation and motion of clouds and other Mars meteorological phenomena.

Mariner 6 will begin taking full planet pictures two days before it reaches Mars, Mariner 7 about three days before encounter. (SEE PAGES 12 and 13).

A new high-rate telemetry system--16,200 bits per second-- on the Mariners and the use of the 210-foot antenna at the Goldstone Space Communications Station in the Mojave Desert allows the two spacecraft to record and play back an enormous amount of picture data during the approach to Mars. In the standard mission, programmed into the on-board computer prior to launch, Mariner 6 will take 50 approach pictures beginning 48 hours and 770,000 miles from Mars and ending 7 hours and 112,000 miles from Mars. Mariner 7 will take 93 approach pictures beginning 72 hours and 1,140,000 miles from Mars and ending 4 hours and 65,000 miles from Mars. Only TV camera B, the high resolution camera, will be used for taking far encounter pictures.

Each spacecraft must receive and act upon certain ground commands to initiate the standard mission sequence. These commands must be transmitted to Mariner 6 about 52 hours prior to closest approach and to Mariner 7 about 76 hours before its closest approach.

(As a backup to the standard mission in the event that certain problems occur between now and encounter, a conservative mission has been designed and programmed into each spacecraft to operate on an automatic basis or by specific command. It consists of eight approach pictures taken by each spacecraft between 22 and 11 hours before closest approach. The pictures would be stored on tape and played back at the normal science playback data rate--270 bits per second--after the spacecraft passes Mars. The near-encounter sequence would remain the same as in the standard mission. Neither high-rate telemetry nor ground command capability is required to conduct the conservative mission.)

If both Mariner 6 and Mariner 7 conduct the "standard mission," it is possible to acquire as many as 143 far encounter TV pictures. The high-rate telemetry system, the 210-foot antenna at Goldstone and a microwave link between Goldstone and the Jet Propulsion Laboratory in Pasadena, permits the real time display of the pictures as they are played back from each spacecraft.

Approximately 12 hours of real time TV may be available in five playback sessions. Every five minutes, a new picture--each containing more than half-a-million photo elements--is seen on monitors at JPL. The disc of Mars gets larger with successive pictures until the planet fills, then spills over, the edges of the frame. (SEE PAGES 12 and 13). The five playbacks occur as follows:

Mariner 6, 33 pictures, 7/29	6:35 p.m. - 9:27 p.m. PDT
Mariner 6, 17 pictures, 7/30	6:00 p.m. - 7:27 p.m.
Mariner 7, 34 pictures, 8/2	6:05 p.m. - 9:00 p.m.
Mariner 7, 34 pictures, 8/3	7:24 p.m. - 10:19 p.m.
Mariner 7, 25 pictures, 8/4	6:08 p.m. - 8:19 p.m.

Each of the five real-time TV playbacks occurs during the evening hours California time due to the 210-foot antenna view period.

NEAR ENCOUNTER

Mariner near encounter can be defined as a one-hour period beginning 35 minutes before closest approach to Mars and ending when the spacecraft re-appears from behind the planet. Duration of near encounter including occultation is 68 minutes for Mariner 6 and 74 minutes for Mariner 7.

At about 15 minutes before closest approach, the two TV cameras--shuttering alternately every 42 seconds--the IR radiometer, IR spectrometer and UV spectrometer will begin taking planetary data, some of which is transmitted directly to Earth and all of which is recorded on board the spacecraft. During near encounter, real-time transmission of data to Earth will be at the high-rate 16,200 bits per second. It will include every seventh TV picture element for photometric measurements.

Receipt of the entire picture on Earth will occur during the post-encounter tape recorder playback. Near encounter TV totals 24 pictures--12 high resolution and 12 medium resolution--during a period of about 17 minutes. The Mariners reach their nearest proximity to Mars during the last few minutes of the close-up TV sequence.

When the TV swath of overlapping pictures crosses the day/night terminator, picture recording ceases. The other instruments continue taking and recording dark-side data out to and beyond the limb of Mars about 10 minutes after closest approach.

Occultation--that period when Mars is between the spacecraft and Earth--begins several minutes after the end of science recording and lasts about 20 minutes for Mariner 6 and 29 minutes for Mariner 7. The occultation data, from which can be determined the density of the Martian atmosphere, is obtained at Earth tracking stations at both entry and emergence from behind the planet. Tracking data obtained throughout encounter as well as during the entire flights, contributes to the celestial mechanics experiment.

POST-ENCOUNTER PLAYBACK

Following occultation, the near encounter science data recorded on two tape recorders--one analog, one digital--aboard each Mariner is played back. The digital recorder, which stores only near encounter data, including TV, is played back at the normal science playback rate, 270 bits per second. About 19 hours after closest approach for Mariners 6 and 7, the digital playback is interrupted for two playbacks of the analog recorder totaling five hours (near encounter TV only) at the high rate, 16,200 bits per second. Mariner 6 playback is interrupted also for the Mariner 7 far encounter sequence. After both spacecraft have completed the playback several times--about August 17--they continue to provide additional tracking and spacecraft performance information until the mission is terminated.

MARINER 6/MARINER 7 MARS ENCOUNTER LOG

PACIFIC DAYLIGHT TIME (PD^T)

EVENT

Monday, July 28, 1969

6:19 p.m. Ground command, transmitted from Goldstone, turns on Mariner 6 science power and starts shuttering TV camera.

8:49 p.m. Mariner 6 scan platform is pointed at Mars so that Far Encounter Planet Sensor (FEPS) sees planet and begins tracking Mars' center of brightness to keep TV camera pointed accurately at Mars.

10:26 p.m. Mariner 6 takes first of 33 far encounter pictures from a distance of 771,500 miles. Entire sequence consumes 19 hours, 44 minutes, with one picture taken each 37 minutes.

Tuesday, July 29

6:10 p.m. Mariner 6 takes picture #33.

6:35 p.m. Mariner 6's first picture (M6-1) is received at JPL following high-rate transmission from the spacecraft. All 33 pictures are displayed on TV monitors at JPL as they are received about five minutes apart. Playback duration for 33 pictures is 2 hours, 52 minutes.

9:27 p.m. Receipt of M6-33 is completed.

Wednesday, July 30

12:23 a.m. Mariner 6 takes picture #34 (M6-34), the first of a series of 17 pictures. One picture is taken each 56 minutes during a duration of 15 hours, 56 minutes.

3:19 p.m. Mariner 6 takes picture #50 at altitude of 111,950 miles.

6:00 p.m. Beginning of real-time receipt and display of M6-34. Playback duration for 17 pictures is 1 hour, 27 minutes.

7:27 p.m. Receipt of M6-50 is completed.

PDT

EVENT

Wednesday, July 30, 1969 (con't)

9:43 p.m.	Start Mariner 6 near encounter sequence with cooldown of Infrared Spectrometer.
10:03 p.m.	Mariner 6 begins recording data from science instruments--Infrared Spectrometer, Ultraviolet Spectrometer, Infrared Radiometer.
10:04 p.m.	High and medium resolution TV cameras each take 12 pictures with the medium resolution pictures overlapping and high resolution covering small areas within the overlaps. Twenty-four pictures are recorded in 17 minutes.
10:18 p.m.	Mariner 6 makes its nearest approach to Mars. Estimated altitude is about 2000 statute miles.
10:21 p.m.	Mariner 6 takes last near encounter TV picture (M6-74). Other science instruments continue taking and recording data into the Martian night.
10:28 p.m.	End recording Mars science.
10:34 p.m.	Start playback to Earth of science data recorded on spacecraft's digital recorder during near encounter.
10:36 p.m.	Enter occultation. Ground station at Goldstone loses Mariner 6 radio signal as spacecraft disappears behind Mars.
10:56 p.m.	Exit occultation. Goldstone regains Mariner 6 radio signal as spacecraft emerges from behind Mars. Digital science playback continues.

Thursday, July 31

5:36 p.m. (approx.)	Start high-rate playback of Mariner 6 encounter pictures (M6-51 to M6-74) from spacecraft's analog tape recorder. (All near encounter pictures will be played back twice during this session. They will not be displayed on TV monitors.)
11:17 p.m. (approx.)	End high-rate playback M6-74. Resume digital playback until interrupted for Mariner 7 far encounter TV.

PDT

EVENT

Friday, August 1, 1969

5:53 p.m. Transmit ground command to Mariner 7 to turn on power for science instruments and start shuttering TV cameras.

8:23 p.m. Mariner 7 science scan platform slews to far encounter position.

9:59 p.m. Mariner 7 takes M7-1, first of a total of 93 far encounter pictures of Mars, 34 of which are taken during this first of three sequences. Duration of 34-picture sequence is 19 hours, 48 minutes. A picture is taken each 36 minutes. M7-1 is taken from a Mars altitude of about 1,140,000 miles.

Saturday, August 2

5:47 p.m. Mariner 7 takes M7-34

6:05 p.m. Start playback M7-1 and continue real-time display of 34 pictures, one each five minutes. Playback sequence lasts 2 hours, 55 minutes.

9:00 p.m. End playback M7-34.

10:59 p.m. Mariner 7 starts second series of 34 far encounter pictures, recording one frame each 36 minutes for 19 hours, 48 minutes.

Sunday, August 3

6:47 p.m. Mariner 7 takes picture #68.

7:24 p.m. Start playback M7-35. Duration of playback sequence is 2 hours, 55 minutes.

10:19 p.m. End playback M7-68.

Monday, August 4

1:01 a.m. Mariner 7 takes frame M7-69. This final far encounter series numbers 25 pictures taken at 42-minute intervals. The series consumes 17 hours, 48 minutes. The last picture, M7-93, is taken from a Mars distance of 65,550 miles.

5:49 p.m. Take M7-93. At this point, Mariner 7 is 4 hours and 11 minutes from its closest approach to Mars.

-11-

PDT

EVENT

Monday, August 4, (con't)

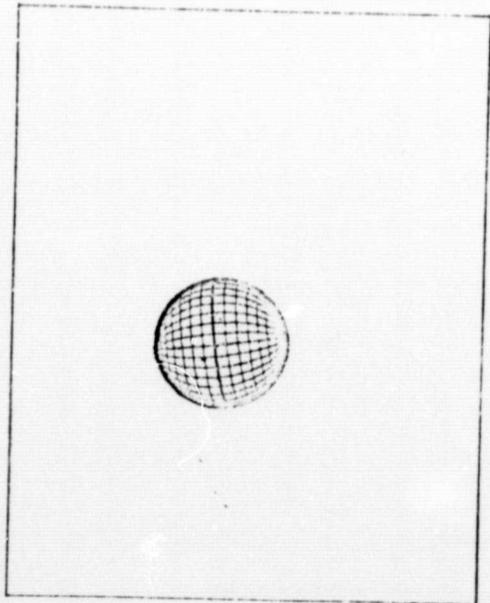
6:08 p.m.	Mariner 7 plays back final series of far encounter TV pictures, M7-69 to M7-93. Receipt of all 25 pictures takes 2 hours, 11 minutes.
8:19 p.m.	End playback M7-39
9:25 p.m.	Begin Mariner 7 near encounter with IRS cooldown.
9:45 p.m.	Start recording Mars science, including 24 near encounter TV pictures (frames M7-94 to M7-117).
10:00 p.m.	Closest approach to Mars (about 2000 miles).
10:02 p.m.	Take TV frame M7-117, concluding TV recording. Continue recording other science data.
10:10 p.m.	End recording Mars science.
10:15 p.m.	Enter occultation. Goldstone loses Mariner 7 radio signal.
10:16 p.m.	Near encounter science data begins playing back, although it begins while Mariner 7 is behind Mars.
10:44 p.m.	Exit occultation. Goldstone regains Mariner 7 radio signal and receipt of data from digital tape recorder begins.

Tuesday, August 5

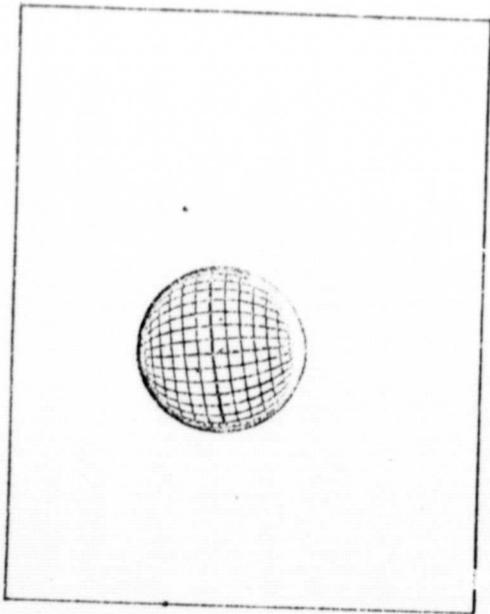
5:20 p.m. (approx.)	Begin high-rate playback of 24 near encounter TV pictures (M7-94 to M7-117) from Mariner 7's analog tape recorder. (All near encounter pictures will be played back twice during this session. They will not be displayed on TV monitors.)
11:22 p.m. (approx.)	End playback M7-117. Resume digital recorder playback. Mariner 6 and Mariner 7 continue transmitting data recorded on digital tape recorders until all has been played back several times (about August 17).

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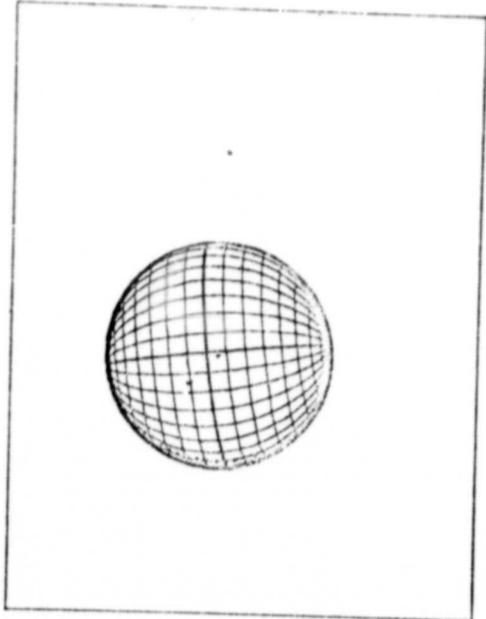
MARS AS VIEWED BY MARINER CAMERAS IN FAR ENCOUNTER SEQUENCES



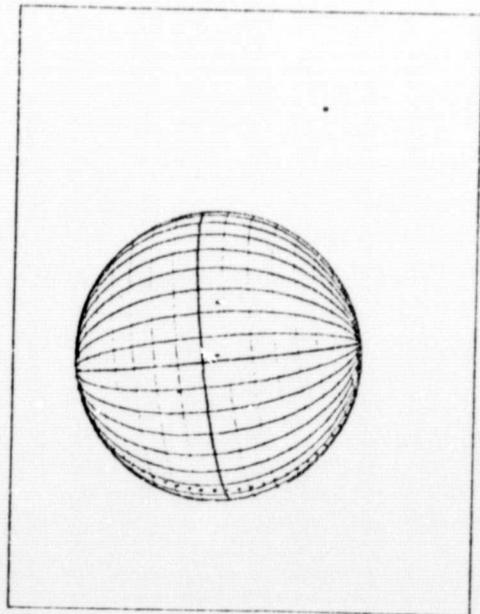
M6-1 771,500 mi.



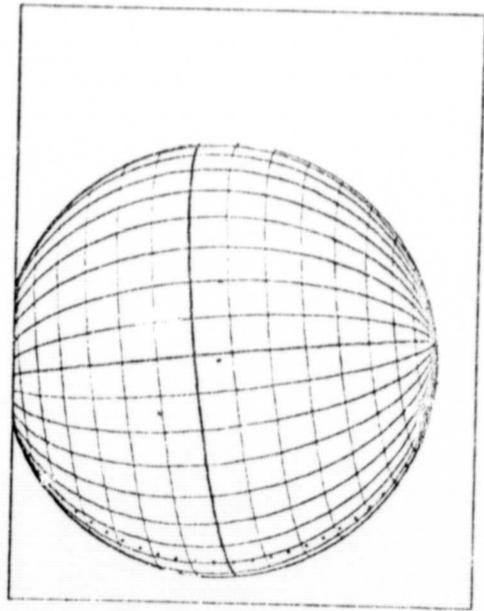
M6-17 612,400 mi.



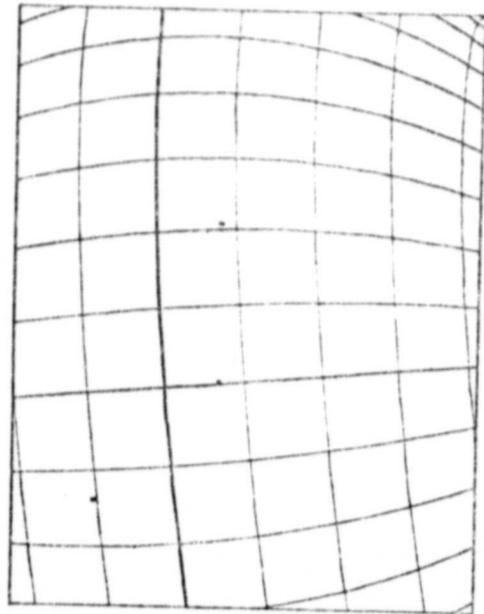
M6-33 453,350 mi.



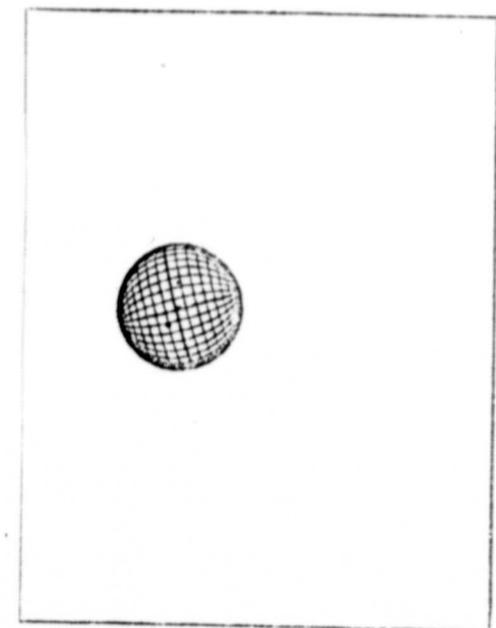
M6-34 353,050 mi.



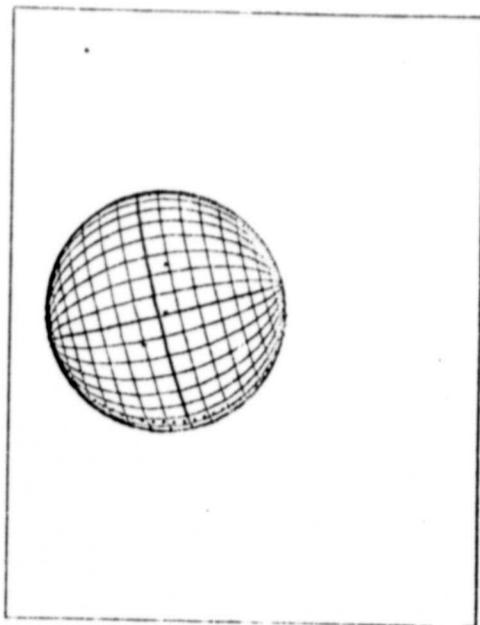
M6-42 232,550 mi.



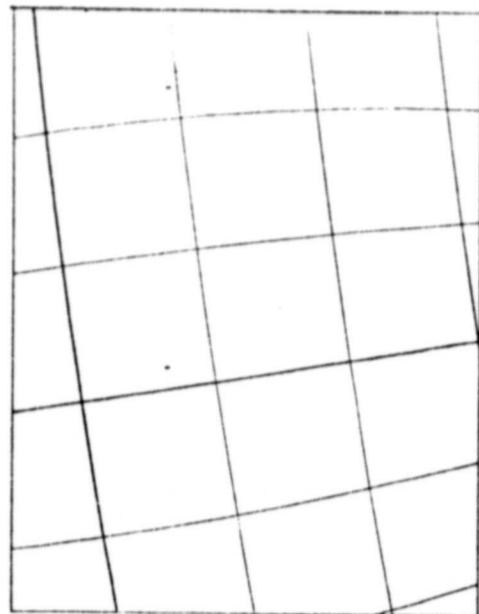
M6-50 111,950 mi.



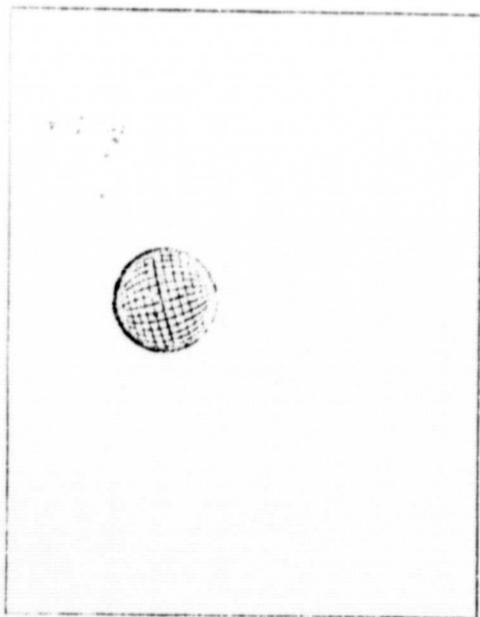
M7-34 827,150 mi.



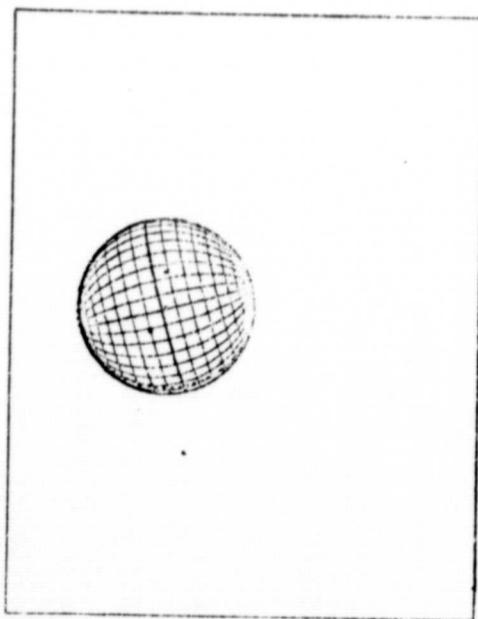
M7-68 431,050 mi.



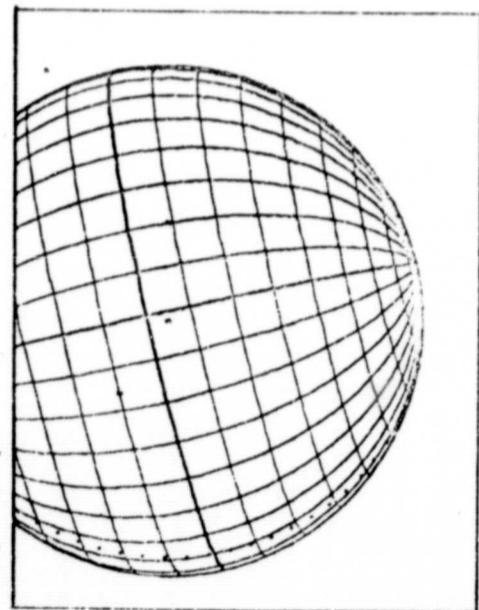
M7-93 65,550 mi.



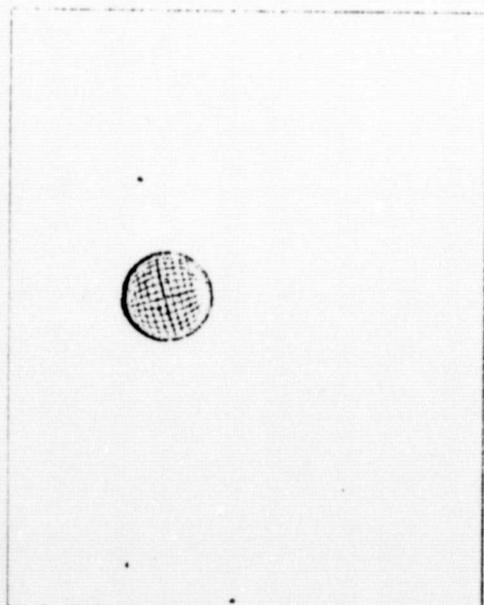
M7-17 988,700 mi.



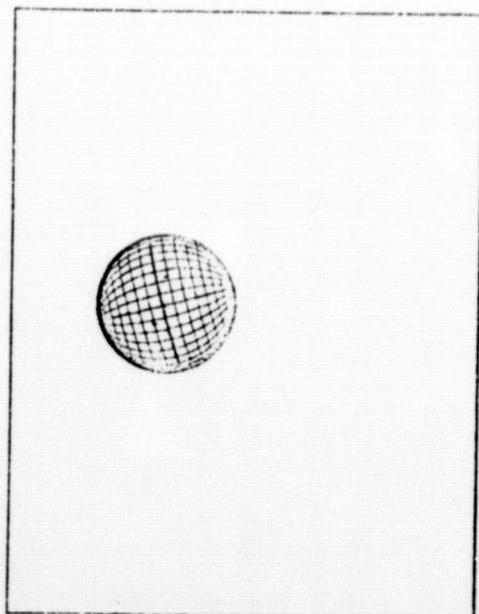
M7-52 583,150 mi.



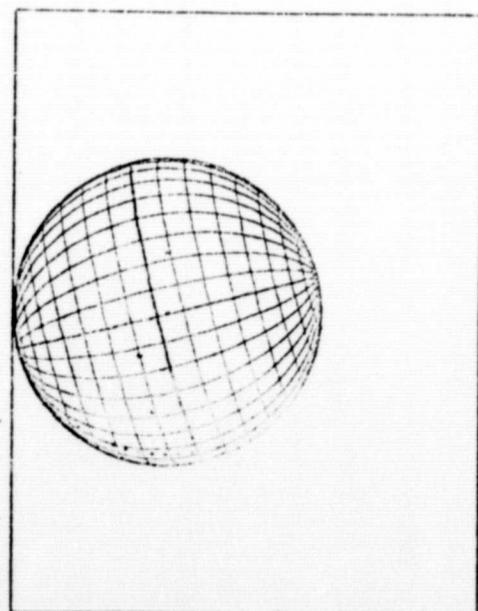
M7-81 199,050 mi.



M7-1 1,140,750 mi.



M7-35 744,750 mi.



M7-69 332,200 mi.